**Unit Title: Teaching Evolution and Making it Relevant**

**Duration: 3 weeks (7 90-minute class periods in block schedule; 2-3-2 sequence)**

**Overview/Description:** Our evolution unit plan presents, over the course of the study period, the origins, development, and current understanding of evolution. It covers aspects of science history, genetics, taxonomy, molecular biology, biochemistry, and ecology. Specific lessons will cover the following topics:

•Explain how theories of gradualism and uniformitarianism influenced Darwin’s ideas about evolution.

•Describe Lamarck’s explanation of how adaptations evolve and compare it to Darwin’s.

•Explain the tenets of Darwin’s theory of evolution by natural selection, using Darwin’s and modern examples.

•Describe how the following give evidence of evolution: embryology, fossils, homology, vestigial organs, and biochemistry.

•Explain evolution by natural selection through a series of simulations and labs.

•Use the Hardy-Weinberg theorem to calculate allele, genotype, and phenotype frequencies in a population at equilibrium. Describe the usefulness and limitations of the HW model.

•Explain how genetic drift, gene flow, mutation, nonrandom mating, and natural selection lead to evolution within a species as well as speciation. Explain and give examples of the three types of selection.

•Explain the causes of genetic variation (mutation, recombination, sexual reproduction) within a population and the prevalence of sexual reproduction as a way of providing variation.

•Describe the evidence for evolution of human beings from a primate ancestor.

**Rationale for Unit:** Evolution is the unifying principle of Biology. All other topics in the field stem from evolutionary processes and relationships. However, evolution is one of the most poorly understood Biology topics among secondary school students. Therefore, we are crafting a unit plan that both explains evolution and makes it relevant to student lives. This will help engage student interest as well as showing them the importance of understanding this critical foundation of Biology.

**Links to standards:**

* NGSS HS-LS-3
* NGSS HS-LS-4

**Unpacking the Standards**

Upon completion of the unit, students should be able to:

• Explain that individuals with physical or behavioral traits that better suit their environment are more likely to survive and

reproduce than those without such traits

• Explain that “differential reproductive success” is a comparison of how many offspring individuals are able to leave behind.

• List the following facets of Darwin’s theory of natural selection: 1) genetic variation of offspring, 2) limited environmental  
 resources cannot possibly sustain all the offspring produced by every individual, and 3) differential reproductive success

• Recognize natural selection as the process by which evolution occurs

• Explain that natural selection acts on individuals, while evolution acts on populations.

• Explain the role of mutation, crossing over, and independent assortment in creating genetic variation

• Recognize that new gene combinations lead to different traits in individuals

• Describe how new traits may be advantageous or disadvantageous, depending on the environmental pressures

• Propose an environmental condition and devise both advantageous and disadvantageous traits for that condition

• Define divergence as the accumulation of differences between groups

• Define speciation as the formation of new species

• Explain that natural selection results in divergence, and that divergence leads to speciation.

• Recognize that organisms which are geographically isolated are essentially no longer able to reproduce with one another,

creating the potential for divergence

• Explain that species become extinct when the environment changes and the species’ phenotype is not suited to the new

selective pressures.

• Recall that extinction is a common event on Earth (more extinct species than living)

• Cite the fossil record as evidence of extinction and speciation over eons of time.

• Recognize human ability to genetically engineer organisms for new traits is an extreme form of artificial selection

**Potential Student Misconceptions:**

* “Individuals evolve” when in reality, populations evolve.
* “Organism evolve because they want or need to” as opposed to random adaptation.
* “Chicken and the Egg – environmental changes cause mutations that fit the new environment” rather than

selection among existing phenotypic differences.

* Inheritance of acquired traits – cats lick their fur, which over time has made their tongues rough.
* New species arise from interbreeding of different species (based on their perception of dog mating).

**Driving Question for Unit:** What is evolution and how does it explain my being here?

**Graphical Representation of Topics and Subtopics:**

**Planning Grids**

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| --- | --- |
| **Week #   or Dates** | **Driving Sub-Question** |
| Week 1 – Tue  Week 1 - Thur | What are the historical foundations of evolution?  How do recessive and dominant alleles determine phenotype? |
| Week 2 – Mon  Week 2 – Wed  Week 2 – Fri | How do populations evolve, and what can we predict mathematically about the process?  How do natural and artificial selection result in adaptation of a population over time?  How do evolutionary biologists graphically depict relationships between organisms, and why? |
| Week 3 – Tue  Week 3 - Thur | What do we know about human evolution, and how do we know it?  Summative Unit Assessment |

**Lessons**

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| --- | --- | --- | --- |
| **Day / Date** | **Author** | **Lesson Title (include a link to lesson plan)** | **Brief Description of Lesson** |
| Tuesday, Week 1 | Rachel S. | Introduction to Evolution | The students will be introduced to the theory of evolution, evidence supporting it, and the scientists who developed the theory. |
| Thursday, Week 1 | Rachel S. | Speciation and Heredity | Students will be introduced to basic Mendelian genetics, Punnett squares, recessive and dominant alleles, and how to predict offspring phenotypes. |
| Monday, Week 2 | Kyle B. | Genetics of Evolution | Students will use their prior knowledge of genetics to consider evolution in populations. Students will learn the Hardy – Weinberg equation and what it can reveal about allele frequencies in populations. |
| Wednesday, Week 2 | Kyle B. | Selection and Adaptation | This lesson explores both natural and artificial forces that select for certain phenotypic traits. |
| Friday, Week 2 | Kyle B. | Phylogenetic Trees and Cladograms | Students are introduced to the use of visual representations by evolutionary biologists to depict the relationships between organisms. |
| Tuesday, Week 3 | Rachel S. | Human Evolution | Students explore the emergence of bipedalism and related physical adaptations, emergent behaviors, and chart patterns of hominid migration. |
| Thursday, Week 3 | Kyle and Rachel | Unit Assessment | Summative Assessment |

**Links to Assessment Items**

* Formative assessments are found at the end of each lesson plan in which they occur.
* Unit Assessment